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Taxonomic Paper

Tracheophyte of Xiao Hinggan Ling in China: an updated checklist

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Abstract

Background

This paper presents an updated list of tracheophytes of Xiao Hinggan Ling. The list includes 124 families, 503 genera and 1640 species (Containing subspecific units), of which 569 species (Containing subspecific units), 56 genera and 6 families represent first published records for Xiao Hinggan Ling. The aim of the present study is to document an updated checklist by reviewing the existing literature, browsing the website of National Specimen Information Infrastructure and additional data obtained in our research over the past ten years.

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New information

This is the first complete checklist of tracheophytes of Xiao Hinggan Ling. A total of 1640 species and subspecies are listed, of which 569 species (ontaining subspecific units) represent first published records.

Keywords

Xiao Hinggan Ling; tracheophyte; flora

Introduction

Xiao Hinggan Ling is located in the north of Heilongjiang Province, China. It is a part of the low mountains and lava platforms in northeast China. It is an important part of the Hinggan Ling in northeast Asia. This area intersects with the remnants of the Da Hinggan Ling, the Northeast Plain and the Changbaishan Mountains. The floristic composition of Xiao Hinggan Ling is complex, and the plant species are diverse in Xiao Hinggan Ling. Typical zonal vegetation types in the region are broad-leaved Korean pine mixed forest and Korean pine forest. The broad-leaved coniferous forest in the Xiao Hinggan Ling region of northeast in China is a very important timber resource (Cao and Li 2007). Xiao Hinggan Ling areas have the world's largest virgin forest of *Pinus koraiensis*, known as "The Home Of Korean Pine" (Wu et al. 2013).

The catalogue of tracheophyte published in 2007 (in “Floristics and Distribution of Plants in Xiao Hinggan Ling, China”) includes 1161 species belonging to 439 genera and 114 families (Cao and Li 2007). Among them, there are 59 species belonging to 30 genera and 14 families of clubmosses and ferns, 12 species belonging to 6 genera and 3 families of gymnosperms, and 1000 species belonging to 411 genera and 101 families of angiosperms. This old Checklist is mainly based on the specimen information and plant investigation and collection records of The Herbarium of Institute of Applied Ecology, Chinese Academy of Sciences (IFP). In recent years, China has built a unified platform, the National Specimen Resource Platform of China (NSII) (NSII 2016) integrating digital specimen information in the whole country. The number of plant specimens in NSII was about 24 times that of IFP, reaching 10.42 million. We collect all the tracheophyte specimen information from Xiao Hinggan Ling on NSII and other materials and surveyed the region for more than 10 years. Now we present a new checklist of tracheophyte in Xiao Hinggan Ling.

Materials and methods

The data presented in the checklist are based primarily on the results of field survey for more than 10 years and published information concerning NSII, field plant survey (a list of records and plant photos), "Floristics and distribution of plants in Xiao Hinggan Ling, China" (Cao and Li 2007), The International Plant Names Index (IPNI) (http://www.ipni.org/index.html) and Global Biodiversity Information Facility (GBIF) (GBIF 2014), the newl recorded and new species are obtained from the published taxonomic articles in recent ten years (e.g., Zheng and Cao 2013, Zheng and Pan 2012, Ma 2013, Ma 2014, Wang et al. 2013), and Flora of China (FOC 2013), Species Catalogue of China (Zhu et al. 2015). Scientific name in the original data were transformed into the accepted name in the The Plant List (TPL database) (http://www.theplantlist.org/1.1/about) by Taxonomic Name Resolution Service (TNRS) (http://tnrs.iplantcollaborative.org). Finally, we unified the classification system. PPGI system was used for Pteridophyte (PPG I 2016), Christenhusz system was used for gymnosperms (Christenhusz et al. 2010, Zhang 2017), and APG? system was used for angiosperms (APG IV 2016) (Suppl. material 1).

Newly recorded tracheophytes in Xiao Hinggan Ling

Phylum Pteridophyta

Order Polypodiales

Family Athyriaceae

Athyrium fallaciosum Milde

Family Onocleaceae

Onoclea sensibilis L.

Family Dennstaedtiaceae

Pteridium aquilinum (L.) Kuhn

Order Equisetales

Order Equisetales

Family Equisetaceae

Equisetum ramosissimum Desf.

Order Ophioglossales

Family Ophioglossaceae

Ophioglossum vulgatum L.

Ophioglossum thermale Kom.

Order Polypodiales

Family Dryopteridaceae

Dryopteris austriaca (Jacq.) Woyn. ex Schinz & Thell.

Order Salviniales

Family Salviniaceae

Salvinia natans (L.) All.

Phylum Gymnospermae

Order Pinales

Family Pinaceae

Abies holophylla Maxim.

Larix gmelinii var. *principis-rupprechtii* (Mayr) Pilg.

Picea koyamae Shiras.

Picea obovata Ledeb.

Pinus armandii Franch.

Pinus densiflora Siebold & Zucc.

Phylum Angiospermae

Order Acorales

Family Acoraceae

Acorus calamus L.

Order Alismatales

Family Alismataceae

Alisma gramineum Lej.

Sagittaria trifolia L.

Family Butomaceae

Butomus umbellatus L.

Family Hydrocharitaceae

Najas minor All.

Family Potamogetonaceae

Potamogeton octandrus var. *mizuhikimo* (Makino) H.Hara

Potamogeton oxyphyllus Miq.

Potamogeton perfoliatus L.

Potamogeton polygonifolius Pourr.

Potamogeton pusillus L.

Order Apiales

Family Apiaceae

Anethum graveolens L.

Cnidium dauricum (Jacq.) Fisch. & C.A.Mey.

Eriocycla albescens var. *latifolia* Shan et Yuan

Osmorhiza aristata Makino & Jabe

Ostericum sieboldii var. *praeteritum* (Kitag.) Y. Huei Huang

Pleurospermum uralense Hoffm.

Angelica amurensis Schischk.

Angelica cartilaginomarginata (Makino ex Y.Yabe) Nakai

Angelica decursiva (Miq.) Franch. & Sav.

Angelica gigas Nakai

Angelica nakaiana (Kitag.) Pimenov

Angelica polymorpha Maxim.

Anthriscus sylvestris (L.) Hoffm.

Bupleurum angustissimum (Franch.) Kitag.

Bupleurum bicaule Helm

Carlesia sinensis Dunn

Heracleum hemsleyanum Diels

Heracleum lanatum Michx.

Oenanthe javanica subsp. *rosthornii* (Diels) F.T. Pu

Peucedanum terebinthaceum var. *deltoideum* (Makino ex K. Yabe) Makino

Sanicula tuberculata Maxim.

Family Araliaceae

Aralia continentalis Kitag.

Panax pseudoginseng Wall.

Panax quinquefolius L.

Order Asparagales

Family Amaryllidaceae

Allium anisopodium Ledeb.

Allium leucocephalum Turcz. ex Ledeb.

Allium przewalskianum Regel

Allium sacculiferum Maxim.

Allium schoenoprasum L.

Allium thunbergii G.Don

Family Asparagaceae

Asparagus dauricus Fisch. ex Link

Asparagus trichophyllus Bunge

Convallaria majalis L.

Polygonatum odoratum var. *pluriflorum* (Miq.) Ohwi

Polygonatum odoratum var. *thunbergii* (C.Morren & Decne.) H.Hara

Polygonatum stenophyllum Maxim.

Hemerocallis citrina Baroni

Hemerocallis fulva (L.) L.

Family Iridaceae

Iris setosa Pall. ex Link

Iris ventricosa Pall.

Family Orchidaceae

Epipactis xanthophaea Schltr.

Epipactis helleborine (L.) Crantz

Cypripedium shanxiense S. C. Chen

Habenaria linearifolia Maxim.

Order Asterales

Family Asteraceae

Nabalus tatarinowii (Maxim.) Nakai

Ligularia sachalinensis Nakai

Parasenecio firmus (Kom.) Y.L.Chen

Parasenecio hastatus var. *glaber* (Ledeb.) Y.L.Chen

Picris hieracioides subsp. *japonica* (Thunb.) Krylov

Saussurea chinnampoensis H.Lév. & Vaniot

Saussurea elongata DC.

Saussurea maximowiczii Herder

Saussurea sclerolepis Nakai & Kitag.

Saussurea stoliczkae C.B.Clarke

Saussurea tenerifolia Kitag.

Saussurea tomentosa Kom.

Saussurea ussuriensis Maxim.

Scorzonera austriaca Willd.

Senecio ambraceus Turcz. ex DC.

Senecio cannabifolius var. *integrifolius* (Koidz.) Kitam.

Serratula cupuliformis Nakai & Kitag.

Serratula marginata Tausch

Serratula polycephala Iljin

Solidago decurrens Lour.

Sonchus transcaspicus Nevski

Taraxacum asiaticum Dahlst.

Taraxacum mongolicum Hand.-Mazz.

Taraxacum platypecidum Diels

Taraxacum sinicum Kitag.

Tephroseris kirilowii (Turcz. ex DC.) Holub

Tephroseris palustris (L.) Rchb.

Tephroseris phaeantha (Nakai) C.Jeffrey & Y.L.Chen

Tripleurospermum limosum (Maxim.) Pobed.

Order Asterales

Family Campanulaceae

Adenophora capillaris subsp. *paniculata* (Nannf.) D.Y.Hong & S.Ge

Adenophora grandiflora Nakai

Adenophora palustris Kom.

Adenophora polyantha Nakai

Adenophora stenanthina (Ledeb.) Kitag.

Adenophora stenophylla Hemsl.

Campanula glomerata subsp. *speciosa* (Hornem. ex Spreng.) Domin

Order Boraginales

Family Boraginaceae

Amblynotus rupestris (Pall.) Popov

Eritrichium borealisinense Kitag.

Myosotis laxa subsp. *caespitosa* (Schultz) Hyl. ex Nordh.

Trigonotis peduncularis var. *amblyosepala* (Nakai & Kitag.) W.T. Wang

Arabidopsis lyrata subsp. *kamchatica* (Fisch. ex DC.) O'Kane & Al-Shehbaz

Arabidopsis halleri (L.) O'Kane & Al-Shehbaz

Stevenia cheiranthoides DC.

Cardamine flexuosa With.

Cardamine komarovii Nakai

Cardamine parviflora L.

Cardamine pratensis L.

Dontostemon hispidus Maxim.

Dontostemon micranthus C.A.Mey.

Erysimum perofskianum Fisch. & C.A.Mey.

Erysimum flavum (Georgi) Bobrov

Lepidium apetalum Willd.

Lepidium densiflorum Schrad.

Order Caryophyllales

Family Amaranthaceae

Corispermum macrocarpum Bunge ex Maxim.

Corispermum elongatum Bunge ex Maxim.

Amaranthus albus L.

Amaranthus retroflexus L.

Dysphania botrys (L.) Mosyakin & Clemants

Family Caryophyllaceae

Stellaria cherleriae (Fisch. ex Ser.) F.N. Williams

Stellaria bungeana Fenzl

Cerastium arvense L.

Dianthus repens Willd.

Dianthus superbus L.

Eremogone capillaris (Poir.) Fenzl

Gypsophila oldhamiana Miq.

Lychnis wilfordii (Regel) Maxim.

Minuartia macrocarpa var. *koreana* (Nakai) Hara

Pseudostellaria rupestris (Turcz.) Pax

Silene baccifera (L.) Roth

Silene foliosa Maxim.

Silene jeniseensis Willd.

Silene nocturna var. *brachypetala* (Robill. & Castagne ex DC.) Benth.

Stellaria graminea L.

Family Plumbaginaceae

Limonium bicolor (Bunge) Kuntze

Family Polygonaceae

Atraphaxis manshurica Kitag.

Atraphaxis frutescens (L.) K.Koch

Fallopia dentatoalata (F.Schmidt) Holub

Persicaria maculosa Gray

Persicaria vivipara (L.) Ronse Decr.

Polygonum aviculare var. *fusco-ochreatum* (Kom.) A.J.Li

Polygonum boreale (Lange) Small

Polygonum foliosum var. *paludicola* (Makino) Kitam.

Polygonum kawagoeanum Makino

Polygonum lapathifolium var. *lanatum* (Roxb.) Steward

Polygonum maackianum Regel

Polygonum muricatum Meisn.

Polygonum ochreatum L.

Polygonum patulum M.Bieb.

Polygonum posumbu Buch.-Ham. ex D. Don

Polygonum rigidum Skvortsov

Polygonum sibiricum Laxm.

Polygonum trigonocarpum (Makino) Kudô & Masam.

Rumex aquaticus L.

Rumex crispus L.

Rumex marschallianus Rchb.

Rumex patientia L.

Rumex stenophyllus Ledeb.

Order Celastrales

Family Celastraceae

Celastrus orbiculatus Thunb.

Euonymus hamiltonianus Wall.

Euonymus oxyphyllus Miq.

Euonymus rehderianus Loes.

Parnassia palustris var. *multiseta* Ledeb.

Order Ceratophyllales

Family Ceratophyllaceae

Ceratophyllum demersum L.

Order Commelinales

Family Linaceae

Linum baicalense Juz.

Linum perenne L.

Linum usitatissimum L.

Order Cornales

Family Cornaceae

Alangium platanifolium (Siebold & Zucc.) Harms

Family Hydrangeaceae

Deutzia baroniana Diels

Deutzia parviflora Bunge

Order Dioscoreales

Family Dioscoreaceae

Dioscorea oppositifolia L.

Order Dipsacales

Family Adoxaceae

Sambucus latipinna Nakai

Sambucus sibirica Nakai

Viburnum mongolicum (Pall.) Rehder

Family Caprifoliaceae

Lonicera caerulea L.

Lonicera ferdinandii Franch.

Lonicera japonica Thunb.

Lonicera nigra L.

Lonicera subhispida Nakai

Patrinia scabra Bunge

Patrinia scabiosifolia Link

Order Ericales

Family Balsaminaceae

Impatiens furcillata Hemsl.

Polemonium caeruleum L.

Family Primulaceae

Androsace septentrionalis L.

Lysimachia clethroides Duby

Primula farinosa L.

Primula matthioli (L.) K.Richt.

Primula patens E.A. Busch

Primula pumilio Maxim.

Primula saxatilis Kom.

Order Fagales

Family Betulaceae

Carpinus cordata Blume

Ostryopsis davidiana Decne.

Betula chinensis Maxim.

Betula ovalifolia Rupr.

Betula schmidtii Regel

Family Fabaceae

Melilotus dentatus (Waldst. & Kit.) Pers.

Glycyrrhiza pallidiflora Maxim.

Hedysarum vicioides Turcz.

Hylodesmum oxyphyllum (DC.) X.F. Gao

Melilotus albus Medik.

Oxytropis hailarensis Kitag.

Astragalus chinensis L.f.

Astragalus complanatus Bunge

Astragalus filiformis (DC.) Poir.

Astragalus galactites Pall.

Astragalus monbeigii G.Simpson

Astragalus penduliflorus Lam.

Desmodium oldhamii Oliv.

Glycine max (L.) Merr.

Lathyrus quinquenervius (Miq.) Litv.

Lathyrus vaniotii H.Lev.

Lespedeza cyrtobotrya Miq.

Lespedeza floribunda Bunge

Trifolium hybridum L.

Trifolium pratense L.

Trifolium repens

Vicia cracca L.

Vicia multicaulis Ledeb.

Vicia ohwiana Hosok.

Vicia venosa (Link) Maxim.

Vicia tenuifolia Roth

Quercus dentata Thunb.

Quercus wutaishanica Mayr

Order Gentianales

Family Apocynaceae

Periploca sepium Bunge

Cynanchum acutum subsp. *sibiricum* (Willd.) Rech.f.

Family Gentianaceae

Gentiana caeruleogrisea T.N.Ho

Gentiana scabra var. *buergeri* (Miq.) Maxim. ex Franch. & Sav.

Gentiana zollingeri Fawc.

Swertia perennis L.

Family Rubiaceae

Galium platygalium (Maxim.) Pobed.

Galium rubioides L.

Galium spurium L.

Galium trifloriforme Kom.

Order Geraniales

Family Geraniaceae

Geranium dahuricum var. *paishanense* (Y.L.Chang) C.C.Huang & L.R.Xu

Geranium erianthum DC.

Geranium koreanum Kom.

Geranium krameri Franch. & Sav.

Geranium transbaicalicum Serg.

Geranium wilfordii Maxim.

Order Lamiales

Family Lamiaceae

Phlomoides umbrosa (Turcz.) Kamelin & Makhm.

Phlomoides maximowiczii (Regel) Kamelin & Makhm.

Clinopodium chinense (Benth.) Kuntze

Dracocephalum moldavica L.

Dracocephalum ruyschiana L.

Elsholtzia densa Benth.

Elsholtzia splendens Nakai ex F.Maek.

Isodon inflexus (Thunb.) Kudô

Lamium album subsp. *barbatum* (Siebold & Zucc.) Mennema

Leonurus macranthus Maxim.

Leonurus sibiricus L.

Leonurus sibiricus L.

Lycopus lucidus var. *hirtus* Regel

Scutellaria moniliorhiza Kom.

Scutellaria pekinensis Maxim.

Scutellaria regeliana var. *ikonnikovii* (Juz.) C.Y.Wu & H.W.Li

Scutellaria strigillosa Hemsl.

Stachys riederi var. *hispidula* (Regel) H.Hara

Stachys riederi var. *japonica* (Miq.) H.Hara

Family Linderniaceae

Lindernia procumbens (Krock.) Philcox

Family Oleaceae

Syringa pubescens subsp. *patula* (Palib.) M.C.Chang & X.L.Chen

Family Orobanchaceae

Euphrasia amurensis Freyn

Euphrasia pectinata subsp. *simplex* (Freyn) Hong

Pedicularis sceptrum-carolinum subsp. *pubescens* (Bunge) Tsoong

Pedicularis verticillata L.

Family Phrymaceae

Phryma leptostachya var. *oblongifolia* (Koidz.) Honda

Family Plantaginaceae

Trapella sinensis Oliv.

Callitriche hermaphroditica L.

Linaria vulgaris Mill.

Plantago depressa subsp. *turczaninowii* (Ganesch.) Tzvelev

Pseudolysimachion linariifolium subsp. *dilatatum* (Nakai & Kitag.) D.Y. Hong

Veronica daurica Steven

Veronica rotunda Nakai

Veronica spicata subsp. *incana* (L.) Walters

Veronica stelleri Pall. ex Link

Order Liliales

Family Liliaceae

Gagea pauciflora (Turcz. ex Trautv.) Ledeb.

Gagea triflora (Ledeb.) Schult. & Schult.f.

Lilium brownii var. *viridulum* Baker

Lilium cernuum Kom.

Lilium concolor Salisb.

Family Smilacaceae

Smilax nipponica Miq.

Smilax riparia A.DC.

Order Malpighiales

Family Ericaceae

Arctous rubra (Rehder & E.H.Wilson) Nakai

Arctous alpina (L.) Nied.

Monotropastrum humile (D.Don) H.Hara

Pyrola japonica Klenze ex Alef.

Pyrola renifolia Maxim.

Pyrola rotundifolia L.

Pyrola tschanbaischanica Y.L. Chou & Y.L. Chang

Rhododendron micranthum Turcz.

Rhododendron mucronulatum Turcz.

Family Euphorbiaceae

Euphorbia esula var. *cyparissioides* Boiss.

Euphorbia fischeriana Steud.

Euphorbia hirta L.

Euphorbia maculata L.

Euphorbia pekinensis Rupr.

Euphorbia pilosa L.

Euphorbia sieboldiana C.Morren & Decne.

Euphorbia thymifolia L.

Family Phyllanthaceae

Phyllanthus ussuriensis Rupr. & Maxim.

Phyllanthus urinaria L.

Family Salicaceae

Populus simonii Carrière

Salix bebbiana Sarg.

Salix caspica Pall.

Salix forrestii K.S.Hao

Salix microstachya Turcz.

Salix miyabeana Seemen

Salix rotundifolia Trautv.

Salix starkeana Willd.

Family Violaceae

Viola bangii Rusby

Viola biflora L.

Viola philippica Cav.

Viola prionantha Bunge

Viola rossii Hemsl.

Order Myrtales

Family Lythraceae

Trapa natans var. *bispinosa* (Roxb.) Makino

Trapa natans L.

Family Malvaceae

Grewia biloba var. *parviflora* (Bunge) Hand.-Mazz.

Tilia mongolica Maxim.

Tilia platyphyllos Scop.

Family Onagraceae

Oenothera villosa Thunb.

Oenothera biennis L.

Epilobium amurense Hausskn.

Epilobium angustifolium subsp. *circumvagum* Mosquin

Epilobium ciliatum Raf.

Epilobium minutiflorum Hausskn.

Order Nymphaeales

Family Nymphaeaceae

Euryale ferox Salisb.

Nymphaea nouchali Burm.f.

Order Oxalidales

Family Oxalidaceae

Oxalis griffithii Edgew. & Hook. f.

Oxalis stricta L.

Order Piperales

Family Araceae

Lemna japonica Landolt

Lemna turionifera Landolt

Family Aristolochiaceae

Aristolochia manshuriensis Kom.

Order Poales

Family Cyperaceae

Trichophorum pumilum (Vahl) Schinz & Thell.

Bolboschoenus planiculmis (F.Schmidt) T.V.Egorova

Bolboschoenus yagara (Ohwi) Y.C.Yang & M.Zhan

Carex breviculmis R.Br.

Carex callitrichos var. *nana* (H.Lév. & Vaniot) S.Yun Liang, L.K.Dai & Y.C.Tang

Carex gotoi Ohwi

Carex jaluensis Kom.

Carex kirganica Kom.

Carex kobomugi Ohwi

Carex korshinskyi Kom.

Carex lanceolata var. *laxa* Ohwi

Carex lanceolata var. *subpediformis* Kük.

Carex lithophila Turcz.

Carex maackii Maxim.

Carex mollicula Boott

Carex raddei Kük.

Carex sedakowii C.A.Mey. ex Meinsh.

Carex siderosticta var. *pilosa* H.Lév. ex T.Koyama

Carex xyphium Kom.

Cyperus amuricus Maxim.

Cyperus microiria Steud.

Eleocharis acicularis (L.) Roem. & Schult.

Eleocharis geniculata (L.) Roem. & Schult.

Eleocharis maximowiczii Zinserl.

Eleocharis retroflexa subsp. *chaetaria* (Roem. & Schult.) T.Koyama

Fimbristylis squarrosa Vahl

Fimbristylis squarrosa var. *esquarrosa* Makino

Pycreus flavidus var. *nilagiricus* (Hochst. ex Steud.) Karthik.

Schoenoplectiella juncoides (Roxb.) Lye

Scirpus lushanensis Ohwi

Scirpus sylvaticus L.

Family Eriocaulaceae

Eriocaulon atrum Nakai

Eriocaulon decemflorum Maxim.

Family Juncaceae

Juncus articulatus L.

Juncus grisebachii Buchenau

Family Oleaceae

Fraxinus bungeana A.DC.

Fraxinus chinensis Roxb.

Fraxinus chinensis subsp. *rhynchophylla* (Hance) A.E.Murray

Family Poaceae

Avena sativa L.

Cleistogenes polyphylla Keng f.

Arthraxon hispidus (Thunb.) Makino

Avena fatua L.

Cleistogenes caespitosa Keng

Lolium temulentum L.

Agrostis divaricatissima Mez

Agrostis macrathera Phil.

Alopecurus longiaristatus Maxim.

Alopecurus magellanicus Lam.

Brachypodium sylvaticum (Huds.) P.Beauv.

Bromus richardsonii Link

Calamagrostis emodensis Griseb.

Echinochloa oryzoides (Ard.) Fritsch

Elymus gmelinii var. *macratherus* (Ohwi) S.L. Chen & G.H. Zhu

Elymus kamoji (Ohwi) S. L. Chen

Eragrostis minor Host

Festuca japonica Makino

Festuca ovina L.

Festuca parvigluma Steud.

Glyceria lithuanica (Gorski) Gorski

Hordeum vulgare L.

Pennisetum flaccidum Griseb.

Pennisetum glaucum (L.) R.Br.

Poa acroleuca Steud.

Puccinellia kobayashii Ohwi

Family Typhaceae

Sparganium erectum L.

Sparganium eurycarpum subsp. *coreanum* (H.Lév.) C.D.K.Cook & M.S.Nicholls

Typha minima Funck

Typha przewalskii Skvortsov

Order Ranunculales

Family Asteraceae

Matricaria chamomilla L.

Conyza japonica (Thunb.) Less. ex Less.

Achillea millefolium

Ainsliaea acerifolia Sch.Bip.

Artemisia aurata Kom.

Artemisia brachyloba Franch.

Artemisia brachyphylla Kitam.

Artemisia kawakamii Hayata

Artemisia laciniata Willd.

Artemisia lancea Vaniot

Artemisia oxycephala Kitag.

Artemisia sylvatica Maxim.

Artemisia vestita Wall. ex Besser

Artemisia zhongdianensis Y.R.Ling

Aster alpinus L.

Aster hispidus Thunb.

Atractylodes koreana (Nakai) Kitam.

Atractylodes lancea (Thunb.) DC.

Atractylodes ovata (Thunb.) DC.

Bidens cernua L.

Bidens parviflora Willd.

Bidens tripartita L.

Carpesium macrocephalum Franch. & Sav.

Chrysanthemum indicum L.

Chrysanthemum morifolium Ramat.

Chrysanthemum zawadskii Herbich

Cirsium shansiense Petr.

Dendranthema lavandulifolium var. *seticuspe* (Maxim.) C.Shih

Erigeron annuus (L.) Pers.

Erigeron canadensis L.

Erigeron thunbergii A.Gray

Eupatorium lindleyanum DC.

Kalimeris altaicus var. *millefolius* (Vant.) Wang

Hieracium hololeion Maxim.

Inula britanica var. *sublanata* Komar.

Inula chinensis (Kom.) Kom.

Inula salicina L.

Jacobaea argunensis (Turcz.) B.Nord.

Family Berberidaceae

Epimedium koreanum Nakai

Family Papaveraceae

Corydalis buschii Nakai

Corydalis lineariloba Siebold & Zucc.

Corydalis repens Mandl & Muhldorf

Corydalis speciosa Maxim. ex Regel

Corydalis yanhusuo (Y.H.Chou & Chun C.Hsu) W.T.Wang ex Z.Y.Su & C.Y.Wu

Hylomecon vernalis Maxim.

Family Ranunculaceae

Batrachium kauffmanii (Clerc) Krecz.

Leptopyrum fumarioides (L.) Rchb.

Aconitum jaluense Kom.

Aconitum kusnezoffii var. *gibbiferum* (Rchb.) Regel

Aconitum longecassidatum Nakai

Aconitum monanthum Nakai

Aconitum paniculigerum Nakai

Aconitum septentrionale Koelle

Aconitum tschangbaischanense S.H.Li & Y.H.Huang

Adonis ramosa Franch.

Anemone cathayensis Kitag.

Anemone hepatica var. *japonica* (Nakai) Ohwi

Anemone raddeana Regel

Anemone stolonifera Maxim.

Anemone umbrosa C.A.Mey.

Aquilegia flabellata Siebold & Zucc.

Aquilegia viridiflora var. *atropurpurea* (Willd.) Trevir.

Aquilegia yabeana Kitag.

Caltha palustris L.

Clematis aethusifolia Turcz.

Clematis heracleifolia DC.

Clematis intricata Bunge

Clematis macropetala Ledeb.

Clematis macropetala var. *albiflora* (Maxim. ex Kuntze) Hand.-Mazz.

Clematis nobilis Nakai

Clematis pinnata Maxim.

Clematis serratifolia Rehder

Pulsatilla turczaninovii Krylov & Serg.

Ranunculus cuneifolius Maxim.

Ranunculus japonicus var. *hsinganensis* (Kitag.) W.T. Wang

Ranunculus monophyllus Ovcz.

Ranunculus smirnovii Ovcz.

Ranunculus trichophyllus subsp. *eradicatus* (Laest.) C.D.K.Cook

Thalictrum filamentosum Maxim.

Thalictrum foetidum L.

Thalictrum minus L.

Thalictrum petaloideum L.

Thalictrum simplex var. *affine* (Ledeb.) Regel

Trollius asiaticus L.

Trollius japonicus Miq.

Trollius ledebourii Rchb.

Family Rhamnaceae

Rhamnus arguta Maxim.

Rhamnus diamantiaca Nakai

Rhamnus parvifolia Bunge

Order Rosales

Family Cannabaceae

Cannabis sativa L.

Family Moraceae

Morus alba L.

Family Rosaceae

Sibbaldia adpressa Bunge

Sibbaldianthe bifurca (L.) Kurtto & T.Erikss.

Filipendula glaberrima Nakai

Geum macrophyllum Willd.

Malus mandshurica (Maxim.) Kom. ex Juz.

Potentilla acaulis L.

Potentilla ancistrifolia var. *dickinsii* (Franch. & Sav.) Koidz.

Potentilla centigrana Maxim.

Potentilla flagellaris Willd. ex Schltdl.

Potentilla kleiniana Wight & Arn.

Potentilla rosulifera H.Lâ€šv.

Potentilla simulatrix Th.Wolf

Potentilla supina L.

Potentilla supina var. *ternata* Peterm.

Prunus armeniaca L.

Prunus humilis Bunge

Prunus padus var. *pubescens* Regel & Tiling

Prunus salicina Lindl.

Prunus serrulata Lindl.

Prunus wilsonii (C.K.Schneid.) Koehne

Rubus chamaemorus L.

Rubus crataegifolius Bunge

Rubus humilifolius C.A. Meyer

Rubus idaeus subsp. *melanolasius* Dieck ex Focke

Rubus idaeus subsp. *strigosus* (Michx.) Focke

Rubus parvifolius L.

Sanguisorba canadensis L.

Sanguisorba officinalis var. *longifila* (Kitag.) T.T.Yu & C.L.Li

Sanguisorba × *tenuifolia* var. *grandiflora* Maxim.

Sorbaria sorbifolia var. *stellipila* Maxim.

Sorbus alnifolia var. *lobulata* (Koidz.) Rehder

Spiraea dahurica (Rupr.) Maxim.

Spiraea pubescens Turcz.

Spiraea trichocarpa Nakai

Family Ulmaceae

Ulmus davidiana Planch.

Ulmus parvifolia Jacq.

Ulmus pumila L.

Family Urticaceae

Parietaria debilis G.Forst.

Laportea cuspidata (Wedd.) Friis

Urtica urens L.

Order Santalales

Family Santalaceae

Thesium refractum C.A.Mey.

Family Sapindaceae

Acer negundo L.

Acer truncatum Bunge

Order Saxifragales

Family Crassulaceae

Hylotelephium spectabile (Boreau) H. Ohba

Phedimus hsinganicus (Y.C. Chu ex S.H. Fu & Y. Hui Huang) H. Ohba, K.T. Fu & B.M. Barthol.

Sedum fedtschenckoi Raym.-Hamet

Sedum kamtschaticum Fisch.

Sedum pallescens Freyn

Sedum roseum (L.) Scop.

Sedum telephium L.

Family Grossulariaceae

Ribes burejense F. Schmidt

Ribes giraldii Jancz.

Ribes komarovii Pojark.

Ribes mandshuricum var. *subglabrum* Kom.

Ribes nigrum L.

Ribes procumbens Pall.

Ribes ussuriense Jancz.

Family Haloragaceae

Myriophyllum spicatum L.

Family Saxifragaceae

Astilboides tabularis (Hemsl.) Engl.

Mukdenia acanthifolia Nakai

Chrysosplenium lectus-cochleae Kitag.

Chrysosplenium pilosum var. *valdepilosum* Ohwi

Chrysosplenium serreanum Hand.-Mazz.

Saxifraga laciniata Nakai & Takeda

Saxifraga manshuriensis (Engl.) Kom.

Saxifraga stolonifera Curtis

Order Solanales

Family Convolvulaceae

Calystegia sepium subsp. *spectabilis* Brummitt

Cuscuta chinensis Lam.

Family Solanaceae

Physalis pubescens L.

Order Vitales

Family Vitaceae

***Ampelopsis glandulosa* var. *heterophylla* (Thunb.) Momiy.**

***Ampelopsis glandulosa* var. *brevipedunculata* (Maxim.) Momiy.**

Order Zygophyllales

Family Zygophyllaceae

***Tribulus terrestris* L.**

Analysis

A total of 124 families, 503 species and 1640 species of tracheophytes in Xiao Hinggan Ling have been compiled. Compared with the list of "Floristics and Distribution of Plants in Xiao Hinggan Ling China", The updated list adds 569 species, 56 genera and 6 families to the old list (Table 1, Table 2). Amongst them, there are 1 genus and 8 species of clubmosses, 6 species of gymnosperms, including 6 families, 55 genera and 555 species of angiosperm. The 569 newly added species of tracheophytes belong to 91 families and 267 genera; the results of family size ranking according to the number of species in families are shown in Table 2. The newly added families are Acoraceae, Butomaceae, Linderniaceae, Moraceae, Pedaliaceae and Zygophyllaceae and the results of ranking 56 newly added genera by genus size are shown in Table 3).

Table 1.

Composition of the new checklist of Tracheophyte in Xiao Hinggan Ling.

Taxa	Number of families	Number of genera	Number of species	New families recorded	New genera recorded	New species recorded
Pteridophyta	16	31	67	1	2	8
Gymnosperms	3	6	18	0	0	6
Angiosperms	103	466	1555	8	65	555
Total	122	503	1640	9	67	569

Table 2.

Tracheophyte families and their species diversity in Xiao Hinggan Ling.

Families	Number of families	Species within family

Asteraceae, Ranunculaceae, Rosaceae, Cyperaceae, Fabaceae, Poaceae, Polygonaceae, Apiaceae, Lamiaceae, Caryophyllaceae, Brassicaceae	11	=10 species
Ericaceae, Euphorbiaceae, Plantaginaceae, Salicaceae, Saxifragaceae, Campanulaceae, Crassulaceae, Grossulariaceae, Primulaceae, Amaryllidaceae, Asparagaceae, Caprifoliaceae, Geraniaceae, Onagraceae, Papaveraceae, Pinaceae, Amaranthaceae, Betulaceae, Celastraceae, Liliaceae, Potamogetonaceae, Violaceae	22	5-10 species
Boraginaceae, Gentianaceae, Oleaceae, Orchidaceae, Orobanchaceae, Rubiaceae, Typhaceae, Adoxaceae, Araliaceae, Linaceae, Malvaceae, Rhamnaceae, Ulmaceae, Urticaceae, Alismataceae, Apocynaceae, Araceae, Asphodelaceae, Convolvulaceae, Eriocaulaceae, Fagaceae, Hydrangeaceae, Iridaceae, Juncaceae, Lythraceae, Nymphaeaceae, Ophioglossaceae, Oxalidaceae, Phyllanthaceae, Sapindaceae, Smilacaceae, Vitaceae	32	2-5 species
Acoraceae, Aristolochiaceae, Athyriaceae, Balsaminaceae, Berberidaceae, Butomaceae, Cannabaceae, Ceratophyllaceae, Cornaceae, Dennstaedtiaceae, Dioscoreaceae, Dryopteridaceae, Equisetaceae, Haloragaceae, Hydrocharitaceae, Linderniaceae, Moraceae, Onocleaceae, Phrymaceae, Plumbaginaceae, Polemoniaceae, Salviniaceae, Santalaceae, Solanaceae, Zygophyllaceae	25	1 species

Table 3.

Tracheophyte genera and their species diversity in Xiao Hinggan Ling.

Genera	Number of genera	Size
Chrysanthemum, *Ampelopsis*, *Arabidopsis*, *Arctous*, *Atraphaxis*, *Avena*, *Cleistogenes*, *Corispermum*, *Epipactis*, *Eriocaulon*, *Fimbristylis*, *Oenothera*, *Ophioglossum*, *Pennisetum*, *Phlomoides*, *Phyllanthus*, *Smilax*, *Trapa*	18	=2 species
Acorus, *Ainsliaea*, *Alangium*, *Amblynotus*, *Anethum*, *Anthriscus*, *Arthraxon*, *Astilboides*, *Batrachium*, *Brachypodium*, *Butomus*, *Cannabis*, *Carlesia*, *Carpinus*, *Cnidium*, *Conyza*, *Desmodium*, *Epimedium*, *Eriocycla*, *Eritrichium*, *Euryale*, *Glycyrrhiza*, *Grewia*, *Hedysarum*, *Hylodesmum*, *Leptopyrum*, *Limonium*, *Lindernia*, *Lolium*, *Matricaria*, *Monotropastrum*, *Morus*, *Mukdenia*, *Nabalus*, *Osmorhiza*, *Ostericum*, *Ostryopsis*, *Oxytropis*, *Parietaria*, *Periploca*, *Physalis*, *Pleurospermum*, *Salvinia*, *Sibbaldia*, *Sibbaldianthe*, *Stevenia*, *Trapella*, *Tribulus*, *Trichophorum*	49	1 species

Discussion

This study added 569 new species, 56 genera and 6 families records to the known checklist. There are 2 main reasons for the results. First, the old checklist was obtained from the IFP, which had more than 290,000 tracheophyte specimens, far less than NSII (more than 10.41 milion). Second, some new record species were found through our field survey, such as some invasive species and exotic plants (e.g.*Trifolium repens*, *Helianthus tuberosus* and *Erigeron annuus*) (Van Der Wal et al. 2008). The phenomenon may be due to the increase in the degree of human interference which provides suitable conditions for the invasion of alien plants in the Xiao Hinggan Ling area. In addition, with the warming of the climate, the plant distribution belt moves northward and some plants in the adjacent flora gradually infiltrate into the Xiao Hinggan Ling region, which is also an important reason for the emergence of some newly recorded species in this region (Parmesan and Yohe 2003).

The new list can reflect the plant varieties in the natural ecosystem of Xiao Hinggan Ling. It can provide detailed and reliable basic data for the study of flora, biodiversity and alien plant invasion in Xiao Hinggan Ling (Liu and Ji 1995).

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Supplementary material

Suppl. material 1: New Checklist of vascular plants in Xiao Hinggan Ling-complete doi

Authors: Hongfeng Wang

Data type: Checklist

Filename: New Checklist of vascular plants in Xiao Hinggan Ling-complete.xls - Download file (286.50 kb)